A Planning Revolution
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Abstract

The traditional centralized planning and scheduling of complex fast moving projects are value-added activities. However, centralized scheduling has some severe deficiencies that have plagued managers since the Polaris project when PERT analysis was invented. The primary deficiency has been the insertion of a layer of specialized planning staff between the project manager and the task managers. This causes time delays in information exchange between different layers of the project, diffuses the planning responsibility, and creates the additional expense of the centralized staff. A web-based approach to distributed planning is developed that overcomes these deficiencies, and delivers most of the services normally provided by the central planning staff. This web-based scheduling technique, called simply The RecDel System, focuses on the interfaces between each work area by baselining and tracking deliverables and receivables between work areas. Task managers directly input deliverable/receivable status data via the web and the resulting project status is immediately available to the project manager without the assistance of central staff. Task delivery deficiencies are instantly highlighted and management attention is focused on real problems in essentially real time.

Centralized Planning: Time Lags and Diluted Responsibility

Centralized staff using integrated scheduling software, has been key to the successful implementation of complex projects. The approach traditionally taken is for this scheduling staff to work with each major task manager to lay out a plan of work. This usually takes the form of a schedule showing the interacting flow of activities that the task manager plans to accomplish. The duration of each task is estimated and the various tasks are usually logically related via finish-to-start or start-to-start types of relationships. Then the key receivables from different work areas are defined as well as the key deliverables sent to adjacent work areas. When the initial schedule of each major task area is complete, they are then integrated into one project schedule by connecting the receivables and deliverables between each task area. Thus, the overall project schedule is defined. This initial project schedule definition may take months to complete depending on the complexity of the project, its uniqueness compared to past projects, the level of detail desired by the project manager, and the size and skill of the central planning staff.

"CPM and PERT still tend to be tools for specialists, not managers. Project Management Software is still considered an esoteric instrument by many... Unless project management can formulate unique tools, like it did in the 50s and 60s and develop philosophy and culture tuned to the need of the changing corporate environment, it will soon disappear. Specifically, we need a new model for Project Management, we need a new mission and we need simpler and smarter tools" (Tubman 1993).

The centralized staff is needed primarily because experts are needed to run the scheduling software used to integrate all areas of the project into one project schedule. Centralized staff converts the planning tools used by each task manager into this project software. At a minimum, if all task managers use the same scheduling software, they integrate each separate task plan into one central project schedule. This schedule can be rolled up from the most detailed level to higher summary levels.

The resulting time it takes to complete the project is noted and compared to the project requirement. Normally, there is a stark discrepancy between the initial schedule and the project completion due date. It is a laborious process to re-plan each task area and to make the necessary adjustments to bring the overall project duration within scope. At this point a baseline is established that looks good on paper, and the statusing of the current project activities begins. This baseline project schedule may take up to six months to develop and is again dependent on project complexity, desired level of detail, and scheduling staff size.

The central scheduling staff usually accepts task status inputs from each task manager at a time interval specified by the project manager. Although this statusing interval varies over the life of most projects, statusing usually occurs weekly or monthly. The staff updates the task status of each task area and then generates the current project schedule. This is compared to the baseline plan and the impact on key deliverables and the project completion date is noted. The central staff identifies problem areas, reviews deterioration of slack reserves, and possibly, suggests ways to remedy these difficulties.

The role and value of a centralized scheduling and planning staff is exemplified in these synopses of their project work. However, if examined closely, it may be noted that this value-added role has a cost associated with it. This cost has four major parts:

- The cost of the central staff itself.
- The initial time delay in getting a project baseline schedule established where the planners act in series between the task area managers and the project manager.
- The time delay between the statusing done by task managers and the resulting project status information being available to the project manager.
- Finally, there is the less tangible cost of diluting the responsibility for planning each task between its manager and the scheduling staff.

These costs are real and is the downside of having a centralized planning staff.

"The current approach to planning and controlling complex projects has traditionally been to eliminate uncertainty and change from our projects, or at least treat them as if change will not occur" (Archibald & Lichtenburg 1994).

Change is one of the most intense realities of complex projects. Traditional methods often utilize a central planning group that creates, manipulates and tracks schedules. This basically transfers most of the scheduling responsibility from the cognizant task managers to people who are not responsible for the actual work. These planners often use software that requires a great deal of training to master, thus giving them monopoly of the planning software. The cognizant task leaders responsible for the work are essentially one more step removed from the planning of their work.

Distributed Planning: Immediate Responsibility and Accountability

The advent of web-based operations has opened many opportunities for project streamlining and improvement. At some point, these impacts can be characterized as a revolution because of the subtle and not-so-subtle impacts on business as usual. One of these web-based innovations is to further decentralize project planning and scheduling even for fast moving, complex projects such as often found in R&D, aerospace, and software development.

The primary phenomenon achieved by distributed planning is the removal of this middle layer while providing most of the schedule baselining and tracking functions needed by the project manager. The doers of tasks take direct control of their plans. They define their products, maintain planning data and report progress against a baseline. They ultimately remain totally accountable for their work plans.

This distributed planning approach developed at Caltech's Jet Propulsion Laboratory (JPL), has changed the way it manages its flight projects for NASA. Dubbed the RecDel System, it focuses on the most difficult and most important area in project planning, the interface between task areas. Usually, the task manager is competent to work within the task area assigned. On the other hand, the project manager's key job is to manage the interaction of these task areas so that the overall project comes together within time and cost restraints. Thus, the most important area for the project manager is to properly manage this interface between task areas. At these interfaces appear the intermediate products such as designs, requirements, components, parts, assemblies, subsystems, test plans, etc. This is the land of deliverables (from a task area) and receivables (to a task area), or RecDels for short.

The RecDel System is both the software tool that facilitates this web-based technique, and the conceptual approach to distributed planning. All project members use this system to provide schedule baselining and tracking so that the project can be efficiently managed.

One of the key characteristics of the RecDel System is what it does not have. It does not have complicated sophisticated scheduling software that is powerful enough to integrate each task area into an overall project schedule. As a result, the RecDel System does not require a centralized staff of specialists to manipulate this complex system. Task managers can use simple (or complicated) scheduling software of their choice to plan and schedule their own work areas. These tools provide the necessary receivable and deliverable information that each task leader records in the RecDel system. There is no need for everyone on a project to use the same scheduling software.

The JPL RecDel System

Negotiation and Reconciliation

Project managers break a project down into its major task areas by using a work breakdown structure (WBS) with as much detail as needed by using the appropriate levels of hierarchy in the WBS. The project manager generates a rough top-level schedule as a guide to the project team. The project manager then assigns a manager to each task area. So far this is identical to the traditional approach which uses central staff to assist project scheduling.

The task area manager then develops a plan to accomplish his/her work, and any planning tool (software) can be used by this manager. Normally, this plan would show tasks, the task relationships, needed receivables from, and deliverables to other areas. Task duration is estimated and desired float (reserves) is introduced to handle perceived schedule risk in this work area. This task area plan is the business of the task area manager and there is no need in the RecDel System to translate this plan into the software used by the central staff to produce the project schedule.

When the task manager is satisfied with his/her own plan for the assigned work area, the following data is put into the RecDel System via the web: each receivable is named, its needed date is specified, and the delivering task area is identified. In addition, each deliverable produced by this work area is identified, its expected due date, and the receiving task area is also input into the RecDel System. At the beginning of a project, it is recommended that only deliverables OR receivables be entered into the System, so there is no redundancy. After an initial comparison, missing RecDels can be added.

Both the definition of the deliverable and the delivery date must be agreed upon. The first step is to negotiate the deliverable definition. After a definition is documented, the delivery date can be negotiated. Until both aspects of the negotiation are in agreement, the RecDel is considered and flagged as unreconciled. At this point, the RecDel System identifies the unreconciled RecDels.

All the dangling receivables and deliverables must be coupled. It is up to each task manager to find out where his/her unacknowledged deliverables go and where missing receivables are coming from. Sometimes, it is a simple matter of the wording that does not make sense to the other party, or having attributed the receivable to the wrong source. Sometimes, however, it is not that simple, and someone needs a receivable that is not being generated by anyone in the project. This is important to know so it can be arranged for others to include that receivable into their planned work. Then there is the surprising situation in which one person is to generate a deliverable that no other work area thinks it needs. Again, this is something to correct in the plan of the individual responsible for it. Upper project management can easily identify all the receivables/deliverables that are unreconciled, and which task manager is responsible for them.

When all the deliverables/receivables are paired up, timeliness becomes an issue. Deliverables must be delivered before or at the time they are due. This may require some serious negotiation with the person on the other side of the interface. If the conflict cannot be reconciled and a mutually acceptable date cannot be found, the matter is brought up to the appropriate level of management for help in resolving the conflict. Ultimately, the top-level schedule, which is used as a goal by the various task managers, may need adjusting based on underlying project realities. Also, it may be necessary to allocate reserves to particular areas to have critical work done in a more timely manner. All of this adjusting of the interfaces between project area occurs as a result of the RecDel System identifying the various states of the receivables/deliverables. *"Network-based techniques as planning tools do not*

consider the issue of uncertainty in identifying tasks and the relationship among tasks in the network" (Morad & Vorster 1993). Central scheduling staff is not used to integrate the project plan (taking months) and to identify scheduling problems. This is done immediately and directly by task area managers and sometimes done with the assistance of higher project management.

Receiver Accepts Delivery

When all receivables/deliverables are properly planned, the project baseline is established. Statusing is done regularly by each task manager by simply inputting into the RecDel System when deliverables are indeed delivered. However, the deliverable is not accepted as delivered until the person receiving it says it's delivered. (This is the RecDel System equivalent of the maxim that "it's not over until the fat man/woman sings".) This is a key feature of the RecDel System. The person with the most at stake (the person receiving it) is the judge of whether or not a deliverable is adequate.

Renegotiation, Metric Reports and E-mail Notification

Someone may at any time, as it becomes obvious, indicate that a deliverable will be late and enter the new date into the RecDel System. This is called a broken agreement. When this happens, or when a deliverable due date is missed, or when an item is not statused promptly, the RecDel System raises a red flag. These situations are made known simultaneously to the other party and to appropriate upper management. They are reflected in metric reports generated by the System. This brings immediate attention to exactly the right people without central staff needing to play any intermediate role. In addition to notification of late deliveries or broken agreements, the RecDel System also sends out e-mail notices to remind the parties involved of approaching deliveries.

Thus, the time to get the schedule baselined is reduced since there is no need for central staff to integrate all schedules into a single project schedule, and for a limited central staff to play a brokering role in mediating schedule conflicts. Task managers can start resolving interface problems as soon as they put their data into the RecDel System. Also, statusing info is put directly into the system, and as things become unglued, the relevant managers are notified immediately with due notice to appropriate managers.

If there is a period where there are no receivables/deliverables identified within a work area, management can request that some tasks internal to a work area be artificially called a deliverable/receivable so that they can be entered into the RecDel System. This allows tracking of key activities that are important to a task area even though they are not delivered to another work area. The "granularity" of the RecDel System can be adjusted to be what is necessary to provide adequate tracking of the project without the undo burden of being too detailed.

Ease of Use

The RecDel System is easy to use. Training time for task managers is about 10 minutes. It is low cost—only a couple of weeks are needed to set up the system and train Project Management personnel on a typical $200 million dollar project. Compared to the central staff approach, it eliminates the time delays associated with initial baselining of the project and the periodic statusing of the project. It takes some time each day over several weeks, to train key management to effectively use the report information that is created.

The Downside

At the present time, the project manager loses some information because there is no integrated project schedule based on logically related tasks. For example, there is no explicit definition of a project critical path. Also, since not each task within a task area is defined in the RecDel System, tasks cannot be cost loaded; task based earned value analysis can not be accomplished. The total schedule float for key deliverables is not available as an indicator of schedule reserves. Estimating time to complete is also awkward with the RecDel System. Although all receivables and deliverables throughout the project are known and controlled, it is not exactly known how slips of deliverables across the project affect the completion of the project. This important information is not available to the project manager using the RecDel System for lack of the analytical tools. There is no free lunch....

Not surprising, some of these characteristics of the RecDel System can be overcome with additional software development. It would be relatively straightforward to cost load each deliverable in each task manager's plan. Thus, earned value analysis and the ability to estimate cost to complete could be easily achieved. This future development may or may not occur at JPL. There also are plans to introduce a simple planning tool such as MS or MAC Project into use within the RecDel System. This would cut down on double data entry and allow insight into the critical path.

But is lack of a critical path really a "downside"? *"Older packages emphasize the critical path method, which can be very clumsy when scheduling people. Classic approaches tend to be expensive and rooted in legacy technologies"* (Wood 1995). While critical path analysis is currently beyond the ability of the RecDel System, an experienced scheduler can track down the critical path by tracing RecDels through the system. Therefore, it is currently labor intensive, but not impossible, to track the critical path of a project with only RecDel information.

Summary

Is this really a revolution in project planning? Revolutions are difficult to recognize in real time. Until history is written from the prospective of the future, it is difficult to prove that a revolution has happened. For the present, one is left to depend on intuition, which is a less than reliable source of knowledge. However, after witnessing the actual implementation of this distributed planning technique at JPL on several projects including the Cassini Project to Saturn, a large, complex project with a swirl of changes, the RecDel System is inspirational in its simplicity and cost effectiveness. It has changed basic relationships within the project and expedited communication in a surprising and effective way. On the Cassini project, a centralized planning staff of 20 was reduced to 3 after the initial software was developed. With the current state of software development, a central staff of 0.1 person is sufficient to run this system for a typical JPL project today, which is in the project cost range of $100 to $200 million. This is less than 0.05% of a project cost. Impressive!

One can reasonably expect to overcome some of the shortcomings of the RecDel System, but not all of them. Some projects may need some additional schedule control staff who could provide additional support without diluting the effectiveness of the project control delivered by the RecDel System.

Distributed planning with the JPL-developed RecDel System has achieved the goal of good project baseline definition as well as good cost-effective project tracking. It has removed the worst aspects of a central planning staff which is the mumbo-jumbo kind of input from a staff member who is wedged between the doers of the work, the task area managers, and the project management. Thus, the doers of tasks are totally and directly responsible for their own planning and task execution, and the project manager receives almost real time status information on all aspects of the project with the problem areas highlighted immediately. This improved scheduling costs is a fraction of the integrated central planning staff approach.

As far as the scheduling staff is concerned, they no longer have to do the mind numbing data entry needed in plan statusing, nor do they have to translate the initial plan of each task area into the integrated project plan. They are available to do other more interesting tasks that require more insight and experience.

Some information, such as critical path and task float (reserves), is lost for lack of the analytical tools that provide them and are generally helpful in project control. However, the project manager can get most of the value of good project planning and schedule control at a small investment with this RecDel System, and can judicially decide how much more should be invested in other project control techniques. The bottom line is that the project manager does not have to buy the centralized staff of the integrated project plan approach to get schedule control of the project. This gives the manger an important and cost saving choice.

All in all, a case can be made to call this web-based approach to distributed planning, a revolution in planning.

Acknowledgement

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